This document was amended in October 2019 to reflect literature that was released since the original publication of this content in May 2013. This document will continue to be periodically updated to reflect the growing body of literature related to this topic.

URINARY INCONTINENCE

KEYWORDS: Urinary incontinence, urgency urinary incontinence, stress urinary incontinence, mixed urinary incontinence, overflow urinary incontinence

At the end of medical school, the medical student will be able to …

1. Define the causes of transient urinary incontinence.
2. Describe the 4 types of urinary incontinence (stress, urgency, mixed, and overflow) including signs and symptoms.
3. Compare and contrast incontinence as a result of bladder dysfunction verses urethral dysfunction.
4. Demonstrate how to take a comprehensive urologic history for assessment of urinary incontinence.
5. Predict the type of incontinence a patient is experiencing after obtaining comprehensive history for incontinence.
6. Describe the components of the physical examination in a male or female patient with urinary incontinence.
7. Recommend appropriate testing required for a patient with urinary incontinence
8. Be familiar with the treatment strategy for a patient with stress urinary incontinence.
9. Be familiar with the treatment strategy for urgency urinary incontinence/overactive bladder, progressing through first, second, and third line therapies

Urinary Incontinence

Urinary incontinence is a significant quality of life challenge, affecting tens of millions of patients, women and men. Patients may not report incontinence to their primary care providers due to embarrassment or misconceptions regarding treatment. Since incontinence is often treatable and can result in significant impairment in quality of life, it is imperative the health care professional be adept at identifying patients who might benefit from treatment. Treatment of urinary incontinence is dependent on the underlying type of incontinence.

Etiologies

Incontinence can be related to non-urologic or urologic causes. Non-urologic causes of incontinence are usually reversible when the underlying issue is identified and corrected. These transient causes of incontinence can be remembered with the pneumonic "DIAPPERS" (Table 1).

TABLE 1: Transient Causes of Incontinence (*DIAPPERS)*

Cause	Comment
Delirium	Incontinence may be secondary to delirium and will often stop when acute delirium resolves.
Infection	Symptomatic infection may increase urinary tract irritation and resulting incontinence
Atrophy of vaginal tissues	Vaginitis may result in the same symptoms of an infection.
Psychological	Depression may be occasionally associated with incontinence.
Excessive urine production	Excessive intake, diabetes, hypercalcemia, congestive heart failure and peripheral edema can all lead to polyuria, which can exacerbate incontinence.
Restricted mobility	Incontinence may be precipitated or aggravated if the patient is unable to toilet in a timely fashion.
Stool impaction	Patients with impacted stool can have urge or overflow urinary incontinence and may also have concomitant fecal incontinence.
Pharmacologic	
• Sedatives	Alcohol and long-acting benzodiazepines may cause confusion and secondary incontinence.
• Diuretics	A brisk diuresis may overwhelm the bladder's capacity and cause uninhibited detrusor contractions, resulting in urge incontinence.
• Anticholinergics	Many nonprescription and prescription medications have anticholinergic properties. Side effects of anticholinergics include urinary retention with associated frequency and overflow incontinence.
• Alpha-adrenergics	Tone in the bladder neck and proximal sphincter is increased by alpha adrenergic agonists and can manifest with urinary retention, particularly in men with prostatism.
• Alpha-antagonists	Tone in the smooth muscles of the bladder neck and proximal sphincter is decreased with alpha adrenergic antagonists. Women treated with these drugs for hypertension may develop or have an exacerbation of stress incontinence.

There are 4 broad categories for urologic causes of incontinence that account for most incontinent patients: urgency, stress, mixed, and overflow incontinence. These are the result of urethral and/or bladder dysfunction (Table 2). Less common urologic causes of incontinence include anatomic abnormalities such as urinary fistula or ectopic ureteral orifices.

TABLE 2: Etiologies of Incontinence

Urethral Dysfunction 1. Stress Incontinence • anatomic (due to mobility of the bladder neck) • intrinsic sphincter deficiency
Bladder Dysfunction 2. Urge Incontinence Detrusor overactivity: • of nonneurogenic origin • of neurogenic origin Poor Compliance 3. Overflow Incontinence

Urethral Dysfunction

Urethral related incontinence, or stress urinary incontinence (SUI), occurs because of either urethral hypermobility or intrinsic sphincter deficiency (ISD) or a combination of both. Incontinence associated with urethral hypermobility has been called anatomic incontinence, since the incontinence is due to malposition of the sphincter unit. Displacement of the proximal urethra below the level of the pelvic floor does not allow for the appropriate transmission of abdominal pressure that normally aids in closing the urethra. ISD refers to a dysfunction of the proximal smooth muscle sphincter at the bladder neck and is often correlated with more severe stress incontinence. The clinical utility of these terms revolves around complex decisions for optimal treatment and quantification for research, however it is likely that patients who demonstrate stress leakage manifest a combination of pathologies.

Bladder Dysfunction

Bladder dysfunction, either related to storage or emptying, can provoke urgency or overflow incontinence, respectively. Urgency incontinence occurs when the bladder pressure overcomes the sphincter mechanism. Elevation in detrusor pressure may occur from due to an incremental rise in pressure with increased bladder volume (poor compliance) or intermittent abnormal bladder contractions (detrusor overactivity). Poor bladder compliance results from loss of the vesico-elastic features of the bladder or because of a change in neural-regulatory activity. Detrusor overactivity (DO) may be idiopathic or associated with a neurologic disease (neurogenic DO). DO is exceedingly common in the elderly and may be associated with bladder outlet obstruction. Overactive bladder (OAB) has become the popularized term for describing patients with frequency and urgency with or without urgency urinary incontinence (UUI).

Overflow incontinence occurs at extreme bladder volumes or when the bladder volume reaches the limit of the urethral mechanism or the bladder's viscoelastic properties. The loss of urine is driven by an elevation in detrusor pressure which overcomes the outlet resistance but not due to contraction of the detrusor muscle. Overflow incontinence is associated with incomplete bladder emptying caused either by bladder outlet obstruction (BOO) or poor bladder contractility. BOO is more common in men and due to enlargement of the prostate (BPH). It is less common in women but can result from severe pelvic prolapse or following surgery for stress incontinence.

We will spend the remainder of this module exploring the types of urinary incontinence in greater detail with regards to physiology, evaluation, and management.

Female Stress Urinary Incontinence

Please refer to the AUA SUI guidelines for reference materials including treatment algorithm: https://www.auanet.org/guidelines/stress-urinary-incontinence-(sui)-guideline

Case Presentation:

Chief complaint: 57 y/o woman presents to your clinic with complaints of leakage of urine with activity, particularly when she is playing with her grandchildren or gardening.

To guide your history-taking, physical exam, and additional analysis, this initial information should place stress urinary incontinence high on your differential diagnosis. Stress urinary incontinence (SUI), defined by the International Continence Society (ICS) as the involuntary loss of urine on effort or exertion, remains an astonishingly common urologic condition associated with striking clinical and economic sequelae. Despite increasing public recognition, as well as appreciation by the medical community of the impact of SUI, the projected prevalence between 26% to 44% of adult women is likely substantially underestimated secondary to social factors such as embarrassment and fear that preclude open discussion of incontinence symptoms.

What are some important questions to ask this patient regarding their leakage?

The differential diagnosis of SUI included urgency incontinence, overflow incontinence due to urinary retention, fistula or mixed incontinence with both urgency and stress components. Careful history should include the onset, frequency, severity and pattern of incontinence, as well as any triggers and

associated symptoms such as frequency, dysuria, urgency or nocturia. Incontinence may be quantified by asking the patient if she wears a pad and how often the pad is changed. Obstructive symptoms, such as a feeling of incomplete emptying, hesitancy, straining or weak stream, may coexist with incontinence, particularly in female patients with previous pelvic surgery, pelvic organ prolapse or poor bladder contractility. Female patients should be asked about symptoms of pelvic organ prolapse, such as recurrent urinary tract infection, a sensation of vaginal fullness or pressure, or the observation of a bulge in the vagina. All incontinent patients should be asked about bowel function and neurologic symptoms. Response to previous treatments, including pharmaceutical agents, should be noted. Important features of the history include previous gynecologic or urologic procedures, neurologic problems and past medical problems. A list of the patient's current medications, including use of over-the-counter medications, should be obtained.

Although seemingly intuitive, it is important to point out that the history should include subjective bother and treatment goals.

Although the history may define the patient's problem, it may also be misleading. Urgency incontinence may be triggered by activities such as coughing, so that according to the patient's history, he or she would suggest symptoms consistent with stress incontinence. A patient who complains only of urgency incontinence may often have comorbid stress incontinence, termed mixed incontinence.

What are important components of the physical exam for SUI?

Complete physical examination is performed with emphasis on the abdominal, pelvic and rectal examination. In females, the condition of the vaginal epithelium and the degree of urethral mobility is determined. Simple pelvic examination with the patient supine is sufficient to determine if the urethra moves substantially with straining or coughing. A supine or standing stress test should be performed to demonstrate urinary leakage. The most straightforward for of the stress test is asking the patient to cough during the pelvic exam. Negative office stress tests require further analysis for some objective confirmation of SUI prior to invasive treatment. The presence of associated pelvic organ prolapse should be noted as it can contribute to the patient's voiding problems and may have an impact on diagnosis and treatment. A rectal exam includes the evaluation of sphincter tone and perineal sensation.

Any additional office testing indicated for this patient?

Urinalysis: Urinalysis is performed to determine if there is any evidence of hematuria, pyuria, glucosuria, or proteinuria.

Post void residual (PVR): PVR is frequently useful to guide treatment and may be measured either with bladder ultrasound or directly with a catheter. A normal PVR is dependent on the capacity of the bladder and the individual circumstances of the patient, however in most cases, volumes in excess of 200 mL when associated with urinary symptoms should raise concern. A significant PVR urine may reflect either BOO or poor bladder contractility. The only way to distinguish outlet obstruction from poor contractility is with functional urodynamic testing.

What are some optional test which may assist in making the diagnosis or ruling out other causes of this patient's incontinence?

A voiding diary may be used to quantitate the amount of fluid taken in, the amount of urine per void, the number of voids and the number of incontinent episodes.

A pad weight test may be performed in select instances to quantitate the amount of incontinence but is most often reserved for research endeavors.

A uroflow measure the flow that urine is expelled from the bladder. Like a PVR if abnormal it reflects either BOO or poor bladder contractility but does not differentiate between the two.

Urodynamic testing (UDS) is used to accurately diagnose the etiology of patient's incontinence, however current guidelines for both stress and urgency incontinence indicate many patients can be successfully treated without such functional testing. The purpose of urodynamic testing is to examine bladder compliance, detrusor overactivity, urethral function, and to rule out obstruction as a cause of either overflow or urgency incontinence. Urodynamics are often performed prior to invasive therapies and are indicated in patients undergoing repeat procedures following failed treatments. For expanded information, refer to the AUA guidelines on urodynamics: https://auanet.org/guidelines/urodynamics-guideline

Cystoscopy is not routinely required for the diagnosis of incontinence but may be utilized in complex cases where the patient demonstrates hematuria, pyuria, or in the setting of prior surgery.

What are risk factors for development of SUI in women?

Although a diverse suite of pathophysiologic processes contribute to the symptoms of SUI, loss of pelvic floor anatomic support combined with dysfunction of the external urethral sphincter due to both structural and neuromuscular compromise often represent primary etiologies. A delicate orchestration of

defects from genetic, anatomic, metabolic, hormonal, environmental, and neurologic realms inevitably combine to dictate patient symptoms. Prominent factors in women are childbirth, aging, abdominal straining such as chronic cough, obesity, and estrogen loss. Defining reversible pathology for any of these components with certainty is currently limited and therefore the treatment strategies available are designed to temporize the symptom complex. Understanding these expectations assists the surgeons' efforts in counseling patients regarding potential outcomes.

What are treatment options for women with SUI?

Strategies for treatment of stress urinary incontinence are tailored to the amount of incontinence and how it affects the patient. The patient who is severely restricted because of severe leakage with minimal movement may not want to try medical therapy but may opt for surgical treatment, whereas the patient who leaks small amounts infrequently may choose conservative treatment. In most cases, patients move from conservative to invasive measures in a stepwise fashion. Women should be counseled on the risks and benefits of all surgical and non-surgical treatment options. An excellent resource for patients regarding SUI and many other Urologic conditions are materials available online from the Urology Care Foundation: https://www.urologyhealth.org/

Behavioral modification

A variety of strategies to manage fluid and timed voiding, particularly before provocative activities, may assist with the patient's SUI symptoms. Pelvic floor exercises can improve anatomic stress urinary incontinence by augmenting closure of the external urethral sphincter and by preventing descent and rotation of the bladder neck and urethra. To benefit from the exercises, women must be taught to do them properly and they must do them consistently. Adjuncts to learning pelvic floor exercises include pelvic floor physical therapy, weighted vaginal cones, a perineometer or electrical stimulation.

Devices

Vaginal inserts including continence pessaries or commercially available tampon-like devices are options to promote continence by support of the anterior vaginal wall. These are often employed in situations where patients only leak with certain activities (i.e. running) or for women desirous of avoiding more invasive interventions.

Medications

There are currently no FDA-approved medications for treatment of SUI. Topical transvaginal estrogen has been demonstrated to improve SUI symptoms, but evidence suggests that oral estrogens worsen incontinence.

Alpha-agonists such as pseudoephedrine (Sudafed) have been used for the treatment of stress incontinence. The bladder neck and proximal urethra have abundant alpha receptors. Activation of these receptors by alpha-agonists leads to an increase in smooth muscle tone. Tricyclic antidepressants, such as imipramine (Tofranil), although not approved for incontinence, have both alpha-agonist and anticholinergic properties.

Surgical treatment

Surgical therapy for stress incontinence is indicated when a patient doesn't wish to pursue non-surgical therapy or when other treatments have failed. In general, interventions are grouped into the following categories: cystoscopic injection of urethral bulking agents, retropubic suspensions, and sling procedures. Choosing a surgical procedure is a complex decision and there is substantial heterogeneity in the definitions of success between therapies. Patients should be informed of the level of invasiveness, operative risks, and expectations. The most common procedures performed are slings. Pubovaginal slings, often employed in complex situations or for prior failed interventions, most often utilize a patient's own fascia as a graft. Synthetic mesh mid-urethral slings are employed in patients with urethral hypermobility. For expanded information, refer to the AUA guidelines on the surgical treatment of female SUI: https://auanet.org/guidelines/stress-urinary-incontinence-(sui)-guideline. Nuances of counseling regarding use of mesh slings is provided by the American Urological Association (AUA) at https://www.auanet.org/guidelines/use-of-vaginal-mesh-for-the-surgical-treatment-of-stress-urinary-incontinence.

How is Stress Urinary Incontinence Different in Male Patients?

Men who are experiencing symptoms suggestive of SUI will have a history of neurologic condition such as spinal cord injury affecting the bladder neck or more likely will have had a history of surgery for treatment of prostate cancer or BPH. The history will have a similar focus as in a female patient with emphasis on onset, frequency, severity, assessing

for obstructive symptoms and irritative symptoms. Evaluation would include cough stress test, PVR/Urolflow and when appropriate UDS and cystoscopy. Male patients with stress incontinence can be treated with an artificial urinary sphincter or a variety of sling procedures. An artificial urinary sphincter provides continence because a cuff compresses the bulbar urethra. It is considered the gold standard treatment. Male slings provide compression under the urethra and elevate the urethra to a more retropubic position. Slings are best suited for men with lesser degrees of incontinence as determined by a pad weight test. Further information regarding male stress urinary incontinence is provided by the AUA at https://www.auanet.org/guidelines/incontience-after-prostate-treatment.

Urgency Urinary Incontinence/Overactive Bladder

Please refer to the AUA Diagnosis and Treatment of Overactive Bladder (Non-Neurogenic) in Adults for reference material including treatment algorithms: https://www.auanet.org/guidelines/overactive-bladder-(oab)-guideline

Case Presentation:

Chief Complaint: 57 y/o female presents to your clinic with complaints having to urinate frequently due to a strong urge to void with occasional incontinence on the way to the bathroom. This is particularly embarrassing for her as she works in a large corporate office and has had to leave meetings.

Urinary urgency, frequency, nocturia, with or without urgency incontinence are the symptoms that define overactive bladder (OAB). It is important to recognize that OAB in a symptom complex or clinical diagnosis but does not a represent a specific discrete pathological condition and affects both men and women. Understanding the terminology will help assist in your history taking. As defined by the International Continence Society (ICS):

Urinary urgency is described as the sudden and compelling urge to urinate which is difficulty to delay

Urinary frequency is an increase in the number of times a person voids during the wake hours; 7 or less voids is often considered normal, however there is substantial variability in frequency due to sleep habits, fluid intake, medications, and other comorbid conditions

Nocturia is interruption of sleep due to the need to void on or more times during the persons normal sleep period

Urgency urinary incontinence (UUI) is the leakage of urine associated with a strong urge or desire to urinate.

OAB is estimated to have an affect 7%-27% of men and 9%-34% of women, however it is more common for women to experience UUI then men. The prevalence and severity of OAB appears to increase with age. OAB can pose a significant burden to the patient not just in terms of costs for management of the condition, but also in impairment of employment, activities of daily leaving, psychosocial function and quality of life.

What are the important components of the HPI?

In taking a history for patients with complaints of urinary frequency or urgency, or urgency urinary incontinence any standard pneumonic such as "OLDCARTS" (onset, location, duration, characteristics, aggravating factors, radiation, treatment) can be employed to guide your history taking, starting with open-ended questions that encourage the patient to tell their story. In general information from the patient that should be elucidating includes irritative or storage symptoms (i.e. urgency, urgency incontinence, frequency, nocturia), obstructive or emptying symptoms (i.e. hesitancy, straining to void, decrease or interrupted stream, history of retention of urine of incomplete bladder emptying), and symptoms of stress urinary incontinence. Fluid habits can be implicated as an underlying cause of OAB and therefore it is important to assess the quantity, type, and timing of fluid intake.

Symptoms of OAB are subjective and difficult to quantify. It is ideal to try and quantify the number of day and night time voids, degree of urgency, number of leaks, and assess degree of bother. Below are some suggestions you could consider asking a patient:

On average how often do you go to the bathroom (i.e. every hour, etc.)?
Are you able to delay urination once you have the urge to go to the bathroom?
Are you able to get to the bathroom without leaking once you have urge to go to the bathroom?
Do your bladder symptoms keep you from doing things that you want to do?

What are the other important considerations that should be obtained in the past medical history, past surgical history, social history, and medications?

During the history screening questions should be asked to assess for co-morbid conditions that impact bladder function directly. Patients with confounding medical conditions are considered complicated OAB patients or may fall into the category of neurogenic bladder. Neurogenic bladder refers to bladder dysfunction related to storage or emptying due to a brain, spinal cord, or nerve condition. Other comorbidities that can affect bladder function include mobility issues, complicated or poorly controlled diabetes, bowel issues (i.e. constipation), prior pelvic surgeries, and history of prior pelvic malignancies treated with radiation to the pelvis.

Other specific aspects that are important and should be assessed specifically are the use of diuretics, prior non-pharmacologic or pharmacologic management strategies tried by the patient (i.e. anti-muscarinic medications, Kegel exercises, timed voiding)

What are the important components of the physical exam (Male and Female) for evaluation of OAB?

Physical examination should include abdominal exam, rectal/genitourinary exam including a focused neurologic exam, assessment of lower extremity edema, and assessment of cognitive or functional impairments. The abdominal examination is to assess for scars, masses, hernias, and areas or tenderness or possible palpable distended bladder. During the genitourinary exam of men this includes assessment for penile pathology, perineal breakdown, and digital rectal examination to asses for prostate pathology or tightness of the pelvic floor muscles, assess for possible impaction/constipation, sensation and sphincter tone. In the female genitourinary exam includes vaginal examination to assess for pelvic organ prolapse, vaginal atrophy and digital assessment of pelvic floor for pain, muscle tone, or ability to perform a Kegel. Vulvar and perineal skin should be inspected, and sensation assessed. Videos of the genitourinary exams can be found on the AUA Medical Student Education website (https://www.auanet.org/education/auauniversity/for-medical-students/male-gu-exam, https://www.auanet.org/education/auauniversity/for-medical-students/female-gu-exam). The AUA/SUFU guidelines for diagnosis and treatment of overactive bladder (non-neurogenic) in adults recommends assessment for cognitive impairment as it has implications in management of OAB (https://www.auanet.org/guidelines/overactive-bladder-(oab)-guideline).

What is in the differential diagnosis for OAB symptoms (urgency, frequency, urgency urinary incontinence)?

The differential diagnosis for urinary urgency, frequency with or without urgency urinary incontinence is extensive and includes conditions outside the bladder as well as primary bladder related

issues. Conditions such as polydipsia of any cause, constipation, pelvic floor muscle dysfunction, poorly controlled diabetes, use of diuretics, congestive heart failure. Primary bladder conditions included IC/PBS, UTI, bladder outlet obstruction due to BPH, urethral stricture or prior incontinence procedures, decrease bladder compliance for example in a patient with prior radiation to the pelvis, bladder cancer, and foreign body in the bladder.

What office testing should be considered in the initial management of this patient?

UA/microscopy/urine culture: Urinalysis with microscopy is important in ruling out the presence of hematuria or infection. In a patient with irritative bladder symptoms, bladder cancer or carcinoma in situ is a critical diagnosis. The presence of microscopic hematuria (> then 3 RBC/hpf) necessitates a hematuria evaluation (https://www.auanet.org/guidelines/microhematuria). High levels of glucose in the urine could suggest undiagnosed or poorly controlled diabetes mellitus contributing to polyuria and possible polydipsia, Urine culture is only needed if the UA is suggestive of infection, further assessment and intervention should be deferred until the infection has resolved.

Post void residual (PVR): PVR is an assessment of bladder emptying and can be performed with a small ultrasound scanner or via catheterization following the patient urinating. Normal PVR is considered < 50 ml, >200 ml is often considered abnormal and may be related to BOO or poor contractility. In patients with urgency urinary incontinence and OAB the absolute value should be considered in relation to the patient's total bladder capacity. A PVR is not required prior to initiation of behavioral interventions or in non-complicated OAB starting medications. PVR should be assess when a patient has obstructive symptoms, neurologic diagnosis, prolapse, of history of incontinence or prostate surgery prior to medication intervention or if a patient develops obstructive symptoms while on medication therapies or not responding to standard treatment.

Voiding Diary: There are many different types of voiding diaries, but the essence of a voiding diary is that it captures normal intake and voiding behaviors of a patient. Minimum data includes documentation of the time of each void and details surrounding incontinence episodes. Rating the degree of urgency, measuring voided volume, and measuring fluid intake is useful but not required. Diaries are useful to document baseline symptoms, to assess for voided volumes and fluid intake, and assess treatment impact, and patients may use the diaries for self-monitoring.

A voiding diary is a very useful tool in establishing if a patient has urinary frequency with small or large volume voids. The differential diagnosis and management will differ based on the underlying cause.

Normal to large volume voids may indicate nocturnal polyuria if isolated at night or polydipsia. Small volume voids may indicate possible interstitial cystitis (IC), painful bladder syndrome (PBS), genitourinary symptoms of menopause.

What advanced testing may be indicated for the evaluation of OAB/UUI?

Advanced diagnostic tests such as UDS, cystoscopy, or renal ultrasound are not needed in the uncomplicated OAB patient. In patients with complicated histories or patients failing to respond to multiple OAB treatments these tests can then be considered. Which tests are needed are left to the discretion of the treating provider dependent on patient parameters.

Renal/bladder ultrasound: imaging of the kidneys and bladder

Urodynamics: this is an invasive procedure in which a small catheter is placed into the bladder and possible the rectum to assess bladder function and dysfunction. The catheters are designed to record the pressure in the bladder with filling and voiding. Urodynamics are complex test which require training in for performance and interpretation. For expanded information, refer to the AUA guidelines on urodynamics: https://auanet.org/guidelines/urodynamics-guideline

Cystoscopy: evaluation of the bladder in which a camera scope is passed through the urethra and into the bladder. It provides direct visualization of the bladder mucosa and urethra. It may be used to assess for the presence of cancer, foreign bodies, urethral strictures, prostatic architecture, and changes within the bladder suggestive of chronic bladder obstruction.

What are important concepts to remember in discussing treatment options for OAB?

When we consider treatment options for the management of OAB it is important to remember that this is clinical syndrome that typically caries very low morbidity or mortality but can have profound impact on overall quality of life for patients. However, the patient must be motivated and have a desire to achieve improvement in symptoms. It is acceptable for a patient or caregiver to not pursue treatment or to abort further treatment options when improvements are not being achieved. UUI is treated similar to OAB, however it is important to identify patients with risk factors for poor compliance because left untreated this can have detrimental effects on renal function and the primary goal is decreasing bladder pressure.

It is useful for patients to have a basic understanding of bladder function, what is consider normal bladder volume (300-500 ml), the concept of the warning time (time from when one senses the urge to when the bladder contracts to empty), that behavioral interventions are an important component of treatment at all

levels in the algorithm, and that it may take trials of multiple medications or intervention to achieve the desired degree of improvement. It is critical to have a discussion with the patient or caregiver early on to manage expectations and to set realistic goals for improvement.

Failure to a treatment may be considered if there is an absence of symptomatic improvement or if the side effects are intolerable.

What are the treatment options for OAB/UUI?

The treatment options for OAB are clearly separated into 1st, 2nd, 3rd line etc. therapies with progression of increasing risk/benefit ratios and degrees of invasiveness. Though treatment ideally progresses in a hierarchical fashion through the treatments, the clinical framework is not intended to be a rigid algorithm in which patients may only progress with failure of the preceding treatments.

First line therapies: behavioral therapies

There are two approaches to behavioral modifications, one focuses on changing bladder function, the other focuses on the pelvic floor or bladder outlet. Simple approaches that can be provided to patients are things such as modification of fluid intake, timed or scheduled voiding prior to the feeling the sensation of urge, reduction of bladder irritants, weight loss, urge control techniques (i.e. distractions). More complex behavioral interventions such a electrical stimulation, biofeedback, pelvic floor exercises may require specialized training and equipment.

There are numerous behavioral therapies and techniques, however they all require participation of the patient or caregiver, and time from the clinician to explain and assess for understanding. Without these two components, behavioral therapies will be less successful. In addition, behavioral therapies can be utilized in combination with 2nd and 3rd line therapies.

Second line therapies: medications

Medications are the mainstay of second line therapy. There are 2 classes of medication available for use in the treatment of OAB/UUI. Anti-muscarinic medications were the mainstay of treatment for decades until the release of the first β3 adrenergic agonist in 2012. Combination therapy using an anti-muscarinic and β3 adrenoreceptor agonist is appropriate with single drug failure.

Anti-muscarinic medications:

Mechanism of action: work by binding the muscarinic receptor on the detrusor muscle this results in decrease in contractility of the detrusor muscle.

Medications: There are many different anti-muscarinic medications available in the US including: oxybutynin (Ditropan), fesoterodine (Toviaz), tolterodine (Detrol), solifenacin (Vesicare), darifenacin (Enablex), trospium (Sanctura). Oxybutynin, Detrol and trospium have both an immediate release (IR) formulation as well as extended release formulation (ER).

Side effects: dry mouth, dry/itchy eyes, constipation, blurred vision are common. Dyspepsia, urinary retention, UTI, tachycardia, drowsiness, and impaired cognitive function are possible. Use in older individuals should be done with extreme caution as these medications can result in decrease memory recall and altered mentation. Anticholinergic medications may also be linked to development of dementia. Life threatening arrhythmias are rare.

Special Considerations: contra-indicated in patients with narrow or closed-angle glaucoma and should be used with caution in patients with history of impaired gastric emptying or history of urinary retention.

Principles: ER formulations are preferred when feasible over IR formulations due to improved compliance and decrease adverse side effects. There is no compelling data that one medication is superior to others regarding therapeutic efficacy. Differences in dry mouth and constipation may exist. It is not unreasonable to consider an alternative anti-muscarinic or dose adjustment when a patient fails to have therapeutic improvement. In the event of intolerability to a drug switching to another anti-muscarinic or β-3 agonist is reasonable.

β-3 adrenoreceptor agonist:

Mechanism of action: works by binding the β-3 adrenergic receptor on the bladder signaling relaxation of the detrusor muscle.

Medication: Mirabegron (Mybetriq)

Side effects: hypertension, headaches, and UTI. Common side effects reported with anti-muscarinic medications such as dry mouth, dry eyes, urinary retention occur less frequently with Mirabegron.

Special considerations: use is contraindicated in patients with uncontrolled hypertension. Contraindicated in patients on metoprolol and select antiarrhythmic medications

Principles: Currently available in 25 and 50 mg dosage with therapy initiated in most instances at lowest dose.

Third line therapies: procedural interventions

There are three third line therapies for treatment of medication refractory OAB. These can be classified into neuromodulation and end organ treatment. There is not a specific order in which to progress through the treatment options, each treatment has a unique set of risks and benefits. In addition, failure of one 3rd line therapy does not prohibit trial of an alternative 3rd line therapy.

Neuromodulation:

Percutaneous tibial nerve stimulation (PTNS): this is a non-surgical treatment option. PTNS involves stimulations of the posterior tibial nerve to provide effect on the nerves responsible for the bladder and pelvic floor. The patients present to the office weekly for 12 weeks for a 30-minute stimulation session. It carries a very low risk and is considered a non-surgical treatment option. Patients are not required to be off anticoagulation for the procedure to be done.

Sacral nerve stimulation (SNS): SNS is a surgical procedure in which a lead with electrodes placed through the S3 foramen and sits near the nerves that are responsible for bladder function. The lead will generate an electrical current to affect the nerve. Patients will have a "test" phase prior to implantation of the battery (implantable generator). The biggest risk are device infection and malfunction. Except for the brain MRIs, MRI are contraindicated. SNS has added FDA approved for fecal incontinence, and non-obstructive urinary retention.

End Organ:

Intradetrusor botulinum toxin (Botox): Botox works by preventing the release of acetylcholine at the nerve terminals; with a decrease in acetylcholine in the nerve terminals the detrusor muscle is not stimulated and remains flaccid. Generally, it is an office-based procedure in with the bladder is anesthetized with intravesical lidocaine and then the Botox is injected into the detrusor muscle via a cystoscopy.

Alternative management strategies:

When an uncomplicated patient has failed conservative treatment strategies as outline in the 1st, 2nd, and 3rd line therapies, or for some complicated patients' treatments such as urinary diversion or augmentation cystoplasty could be considered. Urinary diversion is when a piece of bowel (typically small

bowel) is isolated from the bowel tract and used as a conduit to bring urine to the skin via a stoma. The ureters can be left attached to the bladder or inserted directly into the bowel segment. Augmentation cystoplasty is where a piece of bowel (preferentially small bowel) is separated from the bowel tract and de-tubularized and used to expand the bladder. Both of these types of procedures are highly specialized procedures that are invasive and have considerable associated risks.

It should also be noted that insertion of a chronic indwelling urethral catheter or suprapubic catheter (SPT) should be considered last resort and reserved for those that are at risk for skin break down or institutionalization due to their urinary incontinence. Urethral catheters carry a risk of irreversible damage to the urethra such as erosion or formation of a patulous incompetent urethra. And both urethral catheters and SPT are at increased risk for catheter-associated infections (CAUTI).

What are the special considerations for patient with poor compliance?

Patients that experience UUI due to a decrease in bladder compliance need early identification and an aggressive approach to management to protect the kidneys for damage. These patients will often have a history of neurologic conditions such as spinal cord injury or myelomengiocele, or history of pelvic radiation. Poor compliance should be considered in any patient with deterioration of renal function or evidence of unilateral or bilateral hydronephrosis on renal ultrasound. Urodynamic is required to make the diagnosis of decreased bladder compliance. In patients with incomplete bladder emptying or elevated PVR either at baseline or with treatment, clean intermittent catheterization will be required to facilitate bladder emptying and lower bladder storage pressures.

Summary:

OAB with or without urgency urinary incontinence are prevalent conditions. The effect to each patient is individual and will vary accordingly. Taking a thorough history and physical examination are the cornerstones for the diagnosis of OAB. Except for UA/microscopy and urine culture, further testing is not essential to diagnosis and management but assist in establishing the diagnosis or help to exclude other possible causes of similar symptoms. There are a wide variety of treatments, and treatment of the patient should be individualized to that patient.

Mixed Incontinence

Stress and urge incontinence often coexist. Mixed incontinence is very common with at least 65% of patients with stress incontinence reporting associated urgency or urgency incontinence. Behavioral

therapy, including pelvic floor therapy, can result in a reduction in incontinence episodes and a patient perceived improvement. Approximately half of patients with combined incontinence (stress and urge) will be relieved of urge incontinence following a procedure for stress incontinence. Patients whose urge incontinence does not respond to anticholinergics preoperatively may have a good response to anticholinergics once their stress incontinence is treated. It is critical to remember that SUI or OAB/UUI without impaired compliance has low mortality and that treatment is not required, but degree of bother is varied, and treatment should be adjusted accordingly

Overflow Incontinence

Treatment of overflow incontinence is geared towards emptying the bladder and is dependent on the causes, anatomic or poor detrusor function. Anatomic cause of obstruction in males is from either urethral stricture disease or prostatic obstruction. Depending on the severity of urethral stricture disease the patient may require a urethral dilation, internal urethrotomy, or an urethroplasty. Prostatic obstruction may be treated with medications or surgical intervention. There are many newer approaches to surgical management of BPH, however transurethral resection remains the "gold standard." When a female is obstructed from previous surgery or from pelvic prolapse, she may benefit from an urethrolysis, removal of the prior sling, or surgical correction of the prolapse. Clean intermittent catheterization is an option in the obstructed patient who does not want or could not tolerate further surgery.

The patient with overflow incontinence secondary to poor detrusor contractility is best treated with clean intermittent catheterization as chronic indwelling catheters are not optimum in the long-term. Indwelling catheters are associated with chronic bacteriuria which predisposes them to bladder calculi and ultimately to squamous cell carcinoma of the bladder. Any foreign object in the bladder can cause or exacerbate elevated bladder pressure which then causes hydronephrosis, ureteral obstruction, renal stones and eventually renal failure.

Indications to Refer to Urology

The main indication to refer the patient with incontinence to urology is failure to respond to behavioral or medical therapies. There is no reason that an internist or family doctor can't do a basic work-up (history, physical, urinalysis, +/- PVR) and counsel the patient on behavioral therapies or consider medical therapy. If the patient fails to respond adequately to medical therapy then referral is warranted.

The presence of hematuria, recurrent infections or complicated incontinence, such as following radical prostatectomy in a male, or that thought to be neurogenic, should always prompt a referral.

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Table 3: Comparison of Stress Urinary Incontinence and Overactive Bladder/Urgency Urinary Incontinence

	Stress Urinary Incontinence (SUI)	Overactive Bladder (OAB)/ Urgency Urinary Incontinence (UUI)
Definition	Leakage with activity Bladder pressure > Urethral pressure	OAB: urgency, frequency ± UUI UUI: Leakage that is preceded by a strong urge to void Urgency: sudden and compelling urge to void Frequency: increased number of times voiding in a day
Pathophysiology	1. Urethral hypermobility 2. Intrinsic sphincter deficiency (ISD)	1. Hypersensitivity 2. Detrusor overactivity 3. Poor compliance
Differential Diagnosis	Urgency urinary incontinence, overflow incontinence, fistula, urethral diverticulum, mixed urinary incontinence	Neurogenic bladder, UTI, bladder cancer, vulvar irritation, pelvic floor dysfunction, bladder outlet obstruction (BPH (men), prior sling, pelvic organ prolapse), idiopathic
Evaluation	1. Urinalysis 2. Cough stress test 3. Assessment of post-void residual 4. Voiding diary 5. Pad weight test 6. Urodynamics testing (UDS) 7. Cystoscopy	1. Urinalysis 2. Assessment of post-void residual 3. Voiding Diary 4. Urodynamics (UDS) 5. Cystoscopy 6. Creatinine (if decreased compliance)
Treatment		
1st Line therapy	Behavioral Therapy/Conservative Therapy 1. PT/Kegel exercises 2. Devices (Pessary, Tampons, Impressa Device) 3. Pads/Protection	Behavioral Therapy/Conservative Therapy 1. Pelvic floor physical therapy 2. Timed or Prompted Voiding 3. Fluid modification (volume and type) 4. Pads/Protection
2nd Line Therapy	Medications: No FDA approved medications for treatment of SUI 1. Vaginal estrogen 2. α-agonists (pseudoephedrine) 3. Imipramine (Tofranil)	Medications: 1. Anti-Muscarinics 2. β-3 Adrenoceptor Agonists
3rd Line Therapy	1. Urethral Bulking Agents 2. Sling (mesh or autologous tissue) 3. Retropubic Suspensions	1. Posterior Tibial Nerve Stimulation 2. Sacral Nerve Stimulation 3. Botulinum Toxin Injection

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